



Enhancing Ration Provision: Biometric Integrated Transparent Smart Ration Distribution System

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Abstract

A parliamentary act of India came into force in 2013 designed to supply financed food grains to nearly 100 crores of people of the country, the right to food act, the PDS has emerged as a revolutionary method designed to enhance the delivery of financed food grains to eligible families. This study aims to refine the ration provision system by incorporating biometric technologies and improving transparency. The research introduces an entirely automated platform named Smart Ration Distribution System (SRDS) which maintains a database of user profiles to monitor their monthly and annual consumption of various financed food grains. SRDS offers several benefits including reducing customer wait times, ensuring reliable authentication and identification of eligible individuals, real-time tracking and monitoring of the distribution process enabling timely interventions and resource allocation based on demand patterns and reducing administrative burdens. Additionally, such a system could be effectively utilized for implementing other social welfare programs such as the Telangana Aasara Pension Scheme, Aarogyasri Ammavadi and Anganwadi. This project aims to develop a user-friendly, highly secure biometric ration distribution system constructed using an Arduino controller under the supervision of a ration distributor.

Keywords: Arduino Controller; Biometric Technology; Radio Frequency Identification; Ration Distribution.

1. Introduction

The provision of government aided food and goods supply is a critical component of community care programs in India, aiming to ensure food assurance for millions of citizens. Despite its importance, the traditional ration allocation system is plagued by inefficiencies and dishonesty, leading to significant outflow and misallocation of resources. To address these stumbling blocks, there is a greater than ever urgency for innovative solutions that enhance transparency and efficiency in the allocation provisions. This paper proposes a Biometric Integrated Transparent Smart Ration Distribution System intended to revolutionize the current ration provision framework in India. By leveraging biometric authentication, the proposed system aims to eliminate fraudulent activities and ensure that ration supplies reach the planned real beneficiaries.

Additionally, the integration of smart technology facilitates real-time monitoring and management of distribution processes, further enhancing answerability, transparency, etc. The key objectives of this study are to assess the efficacy of biometric integration in reducing leakage, analyze the impact of smart technologies on functional efficiency, and assess the overall progress in beneficiary satisfaction. Through comprehensive analysis, this paper aims to reveal how technological advancements can notably improve the integrity and performance of ration distribution systems in India. By addressing the critical issues of fraud and inefficiency, the proposed system has the potential to transform the public distribution landscape, ensuring a more equitable and transparent allocation of resources. This study contributes to the ongoing

discourse on public welfare improvements and offers a viable pathway for enhancing food security in developing nations such as India [1-3].

1.1. RFID Technology

The project proposal aims to implement a cutting-edge method to determine specifics. Utilizing RFID cards to retrieve information represents an innovative approach designed to enhance security and safety. In the past, various types of picture identity cards with seals and signatures were commonly used. However, the introduction of scratch cards, magnetic cards, and smart cards has revolutionized the field and garnered significant attention. Users typically insert these cards into smart card readers, which interpret the data and transmit it to a computer, necessitating physical interaction with the data readers. These systems are widely employed across various environments, facilitated by straightforward programming that simplifies the storage of user data for functions like attendance and identification. The project seeks to incorporate wireless capabilities, enabling data retrieval from a smart card wirelessly using radio frequency technology, thus embracing a new trend in smart ID card technology. Radio-frequency identification (RFID) is a contactless, wireless technology that automatically identifies and tracks tags attached to objects. These tags, which contain electronic data, can be powered and read over short distances through electromagnetic induction (EMI). Some tags function as passive transponders, deriving energy from the interrogating electromagnetic field and emitting microwaves or UHF radio waves. Battery-operated tags can operate over distances of hundreds of meters. Unlike barcodes, RFID tags do not require a direct line of sight with the reader and can be embedded within items. Two RFID cards with various serial numbers are used in the system, which is based on a microcontroller unit to send data. An RFID reader reads data from an RFID card when it is brought close to it; the ARM controller then decodes the data. The LPC2148 controller is used, and the information received is displayed on an LCD panel connected to its output port. Embedded C language software with predetermined programming instructions is compared to the data obtained by the

RF reader [4-7].

1.2. Biometric Technology

Among the latest step forward in protection, safety and authentication procedures biometric technology, with examination based on fingerprints helping as a prominent model. Understanding the elementary philosophy of biometric technology is decisive, and a succinct overview of this technology is provided below. The term "biometrics" refers to computerized methods of recognizing people according to their distinctive physiological or behavioural persona or characteristics. These characteristics are diverse and include layered patterns, iris arrangements, speech patterns, hand contours, fingerprints, facial skin texture etc. Biometric technologies are extensively used in the conception of extremely trustworthy solutions for personal identification and certification. Vigorous identity verification schemes are becoming more and more necessary as deceitful transactions and security infringements occur more frequently. Solutions that rely on biometrics can protect the secrecy of financial transactions and the storage of sensitive data. Biometrics is in high demand in a variety of sectors, including the military, commercial, state, federal, and local domains and thus used here as well. They are essential to the issuance of official identification documents, safe online banking, financial transactions, retail operations, law enforcement, and the provision of healthcare, shown in (Figure 1).

2. Methodology and Architecture

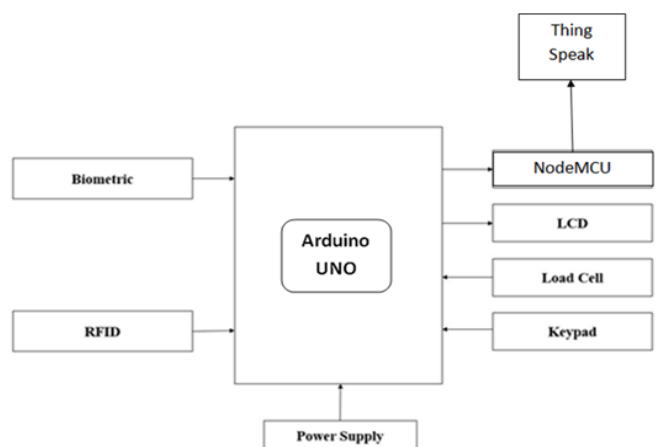


Figure 1 Block Diagram of Smart Ration Distribution System

Simple, Computerized and PWM pins are all included on the Arduino UNO advancement board. It is the idealized stage for an assortment of electronic ventures since it has the Atmega328P chip. Both amateur and master clients can benefit from the Arduino UNO's wide library bolster and ease of programming. Various applications, counting as mechanical autonomy ventures, wearable hardware, and domestic robotization frameworks, are made conceivable by its flexibility. A customary Wi-Fi element that coordinating a microcontroller and Wi-Fi usefulness into a single chip is used, it offers a sensibly estimated arrangement for joining Wi-Fi into a run of electrical applications. The ESP8266 is programmable utilizing the Arduino IDE and has numerous capabilities and capacities, which make it culminate for remote communication ventures, domestic mechanization, and Web of Things applications. Owing to its little estimate, moo control utilization, and reliable usefulness, the ESP8266 could be a broadly favored alternative for remote organizing ventures by both specialists and devotees.

A load cell could be a drive or weight estimation apparatus that's as often as possible utilized in mechanical and weighing applications. A liquid crystal display, LCD for brief, may be a sort of level board show that produces visual yield by utilize of fluid gems. It is as often as possible utilized in electronic gadgets to appear information and empower client interaction shown in (Figure 2). Mechanical switches that are pressed to enact are called thrust buttons. They are commonly utilized to begin forms, set off occasions, or switch between states in electrical gear and control frameworks. For client input, thrust buttons give a basic, material interface. A tiny electric motor known as a servo provides accurate control over the position or rotation of mechanical parts. Because of this, it is extensively utilised in automation, robotics, and remote control systems. One kind of printed circuit board (PCB) used for attaching electronic components is called a vector board. Soldering is a hardware component that is used to attach the components to the board. An open-source, cross-platform Integrated Development Environment

(IDE) is the Arduino IDE. With a few small keyword variations, its programming language syntax is similar to that of the C language. It enables programmers to create code for different sensors and motors, enabling them to respond to human input. Usually used for robotics and Arduino-based applications. An open-source software programme called Fritzing is designed to make the design, prototyping, and documenting of electrical circuits easier. With its intuitive interface, users can create schematics, simulate projects, design circuits, and create PCB layouts. Fritzing makes it easier to assemble and visualise circuit connections using its vast collection of parts and modules. Through the use of a Smartphone application called the Serial Wifi Terminal App, users may connect wirelessly between an Arduino or other microcontroller and their tablet or Smartphone. It provides a wireless network as a handy way to communicate with the device, doing away with the need for physical cords. The app's primary features include wireless data and command sending and receiving, numerous serial protocol compatibility, adjustable baud rates, and real-time data transmission. It simplifies communication with serial devices and makes it easier to remotely monitor and manage systems that are linked [8-9].

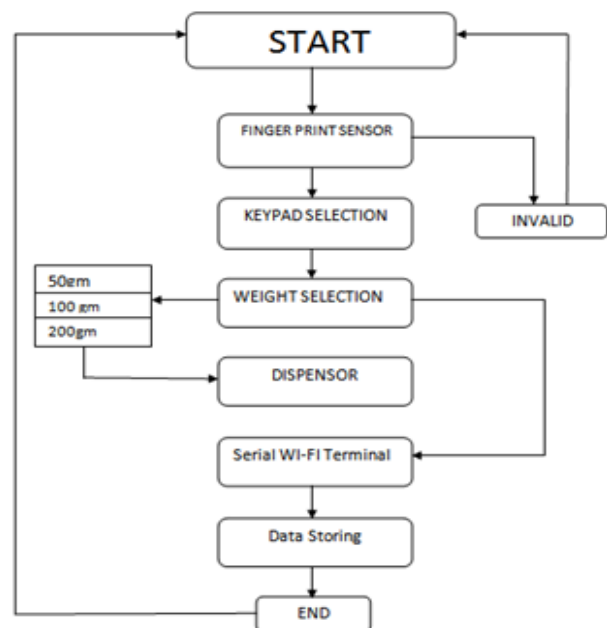


Figure 2 Circuit Diagram of SRDS

3. Results and Discussion

The devised system has effectively met the prerequisites and addressed the previously identified issues. Both the RFID and biometric components operated seamlessly without any issues. During testing, the prototype successfully managed loads up to the specified 1-kilogram limit, as verified by the load cell, shown in (Figure 3 & Figure 4).

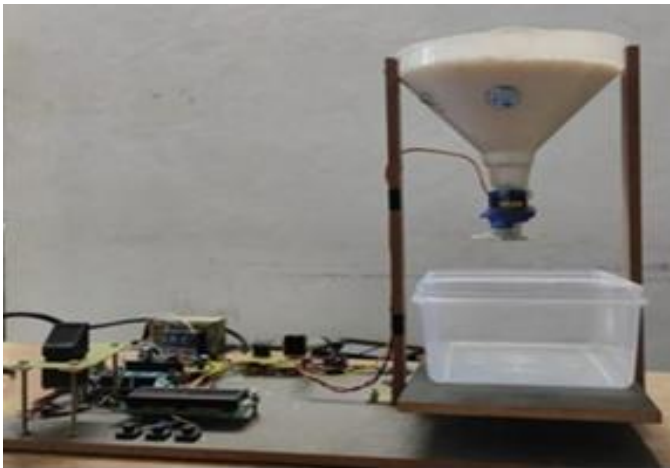


Figure 3 Designed Prototype at Work

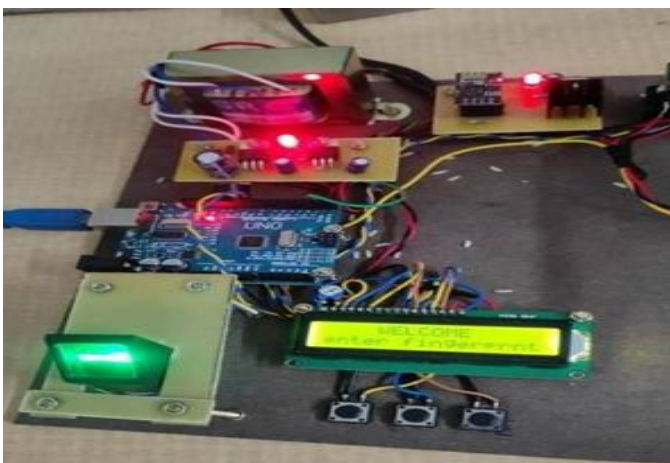


Figure 4 Operational Biometric System

The initiative yielded positive results, including significant enhancements in efficiency, fraud prevention, and transparent record-keeping. The system ensures accurate record-keeping, which is essential for future audits, decision-making, and monitoring projects. These results underscore the practical advantages and effectiveness of the implemented approach.

Conclusion

In conclusion, execution of an intelligent food and goods allocation and distribution arrangement that integrate RFID technology and biometrics enhances the correctness, security, and effectiveness of ration delivery in retail settings to a great extent. This proposed approach computerizes the processes, shrinks human labor and curtails the risk of deceptive activities. By integrating various devices, including RFID readers, fingerprint scanners, microcontrollers, load cells, LCD panels, and NodeMCU with Wifi, the system ensures proficient transfer identification, and authentication of data and operations. The system's capability to record user data, monitor food and goods allocation, and send notifications increases transparency and accountability. Overall, the smart ration distribution system shows significant potential to modernize traditional ration distribution, benefiting both shop owners and recipients. Continued research and development are necessary to further enhance and expand the arrangements capabilities, ensuring its effective realization in real-world scenarios.

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